PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 05 May 2000 (05.05.00)	
International application No. PCT/JP99/05061	**Applicant's or agent's file reference** P21480-P0
International filing date (day/month/year) 16 September 1999 (16.09.99)	**Priority date** (day/month/year) 16 September 1998 (16.09.98)
Applicant YOKOYAMA, Kazuo et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

17 April 2000 (17.04.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Diana Nissen
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

To:

HAGINO, Taira
Eikoh Patent Office
ARK Mori Building, 28th floor
12-32, Akasaka 1-chome
Minato-ku
Tokyo 107-6028
JAPON

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

Date of mailing (day/month/year) 02 April 2001 (02.04.01)	
Applicant's or agent's file reference P-32892	**IMPORTANT NOTIFICATION**
International application No. PCT/JP99/05161	**International filing date** (day/month/year) 21 September 1999 (21.09.99)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address	State of Nationality	State of Residence
OJI-YUKA SYNTHETIC PAPER CO., LTD. 3, Kanda Surugadai 4-chome Chiyoda-ku Tokyo 101-0062 Japan	JP	JP
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [X] the name [ ] the address [ ] the nationality [ ] the residence

Name and Address	State of Nationality	State of Residence
YUPO CORPORATION 3, Kanda Surugadai 4-chome Chiyoda-ku Tokyo 101-0062 Japan	JP	JP
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[ ] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Susumu Kubo
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

特　許　協　力　条　約

EP　US　PCT

国際調査報告

（法８条、法施行規則第40、41条）
〔ＰＣＴ１８条、ＰＣＴ規則43、44〕

出願人又は代理人の書類記号　Ｐ２１４８０－Ｐ０	今後の手続きについては、国際調査報告の送付通知様式（ＰＣＴ／ＩＳＡ／２２０）及び下記５を参照すること。	
国際出願番号 ＰＣＴ／ＪＰ９９／０５０６１	国際出願日 （日.月.年）　１６．０９．９９	優先日 （日.月.年）　１６．０９．９８
出願人（氏名又は名称） 松下電器産業株式会社		

国際調査機関が作成したこの国際調査報告を法施行規則第41条（ＰＣＴ１８条）の規定に従い出願人に送付する。
この写しは国際事務局にも送付される。

この国際調査報告は、全部で　3　ページである。

☐ この調査報告に引用された先行技術文献の写しも添付されている。

１．国際調査報告の基礎

ａ．言語は、下記に示す場合を除くほか、この国際出願がされたものに基づき国際調査を行った。
☐ この国際調査機関に提出された国際出願の翻訳文に基づき国際調査を行った。

ｂ．この国際出願は、ヌクレオチド又はアミノ酸配列を含んでおり、次の配列表に基づき国際調査を行った。
☐ この国際出願に含まれる書面による配列表
☐ この国際出願と共に提出されたフレキシブルディスクによる配列表
☐ 出願後に、この国際調査機関に提出された書面による配列表
☐ 出願後に、この国際調査機関に提出されたフレキシブルディスクによる配列表
☐ 出願後に提出した書面による配列表が出願時における国際出願の開示の範囲を超える事項を含まない旨の陳述書の提出があった。
☐ 書面による配列表に記載した配列とフレキシブルディスクによる配列表に記録した配列が同一である旨の陳述書の提出があった。

２．☐ 請求の範囲の一部の調査ができない（第Ｉ欄参照）。

３．☐ 発明の単一性が欠如している（第Ⅱ欄参照）。

４．発明の名称は
☒ 出願人が提出したものを承認する。
☐ 次に示すように国際調査機関が作成した。

５．要約は
☒ 出願人が提出したものを承認する。
☐ 第Ⅲ欄に示されているように、法施行規則第47条（ＰＣＴ規則38.2(b)）の規定により国際調査機関が作成した。出願人は、この国際調査報告の発送の日から１カ月以内にこの国際調査機関に意見を提出することができる。

６．要約書とともに公表される図は、
第　1　図とする。☒ 出願人が示したとおりである。　☐ なし
☐ 出願人は図を示さなかった。
☐ 本図は発明の特徴を一層よく表している。

国際調査報告

国際出願番号　PCT／JP99／05061

A.　発明の属する分野の分類（国際特許分類（IPC））

Int. Cl⁶　G11B5／60

B.　調査を行った分野

調査を行った最小限資料（国際特許分類（IPC））

Int. Cl⁶　G11B5／60, 5／596, 21／10

最小限資料以外の資料で調査を行った分野に含まれるもの

日本国実用新案公報	1922－1996年
日本国公開実用新案公報	1971－1999年
日本国登録実用新案公報	1994－1999年
日本国実用新案登録公報	1996－1999年

国際調査で使用した電子データベース（データベースの名称、調査に使用した用語）

C.　関連すると認められる文献

引用文献のカテゴリー＊	引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示	関連する請求の範囲の番号
X	DE, 19607379, A (Fujitsu Ltd.) 1. 9月. 1996 (05. 09. 96) &JP, 9－81924, A	1, 3－1 1, 14－1 6, 30－3 2, 38－3 9, 70
A		2, 12－1 3, 17－2 9, 33－3 7, 40－6 9, 71－9 3

☒ C欄の続きにも文献が列挙されている。　☐ パテントファミリーに関する別紙を参照。

＊　引用文献のカテゴリー

「A」特に関連のある文献ではなく、一般的技術水準を示すもの

「E」国際出願日前の出願または特許であるが、国際出願日以後に公表されたもの

「L」優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献（理由を付す）

「O」口頭による開示、使用、展示等に言及する文献

「P」国際出願日前で、かつ優先権の主張の基礎となる出願の日の後に公表された文献

「T」国際出願日又は優先日後に公表された文献であって出願と矛盾するものではなく、発明の原理又は理論の理解のために引用するもの

「X」特に関連のある文献であって、当該文献のみで発明の新規性又は進歩性がないと考えられるもの

「Y」特に関連のある文献であって、当該文献と他の1以上の文献との、当業者にとって自明である組合せによって進歩性がないと考えられるもの

「&」同一パテントファミリー文献

国際調査を完了した日 14. 12. 99	国際調査報告の発送日 21.12.99
国際調査機関の名称及びあて先 日本国特許庁（ISA／JP） 郵便番号100－8915 東京都千代田区霞が関三丁目4番3号	特許庁審査官（権限のある職員） 山澤　宏　5D　9198 電話番号　03－3581－1101　内線　3551

様式PCT／ISA／210（第2ページ）（1998年7月）

国際調査報告

国際出願番号　ＰＣＴ／ＪＰ９９／０５０６１

Ｃ（続き）．　関連すると認められる文献

引用文献のカテゴリー＊	引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示	関連する請求の範囲の番号
Ａ	ＪＰ，９－２３１５３８，Ａ（株式会社日立製作所） ５．９月．１９９７（０５．０９．９７）（ファミリーなし）	１－９３

様式ＰＣＴ／ＩＳＡ／２１０（第２ページの続き）（１９９８年７月）

P.B.5818 - Patentlaan 2
2280 HV Rijswijk (ZH)
+31 70 340 2040
TX 31651 epo nl
FAX +31 70 340 3016

Europäisches Patentamt
Zweigstelle in Den Haag Recherchen-abteilung

European Patent Office
Branch at The Hague Search division

Office européen des brevets
Département à La Haye Division de la recherche

Schwabe - Sandmair - Marx
Stuntzstrasse 16
81677 München
ALLEMAGNE

Datum/Date
04.12.02

Zeichen/Ref./Réf.	Anmeldung Nr./Application No./Demande n°./Patent Nr./Patent No./Brevet n°.
53 360 X	99943376.6-2210-JP9905061

Anmelder/Applicant/Demandeur/Patentinhaber/Proprietor/Titulaire
MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.

COMMUNICATION

The European Patent Office herewith transmits as an enclosure the European search report for the above-mentioned European patent application.

If applicable, copies of the documents cited in the European search report are attached.

☒ Additional set(s) of copies of the documents cited in the European search report is (are) enclosed as well.

EUROPÄISCHES PATENTAMT - DEN HAAG - EUROPEAN PATENT OFFICE - THE HAGUE - OFFICE EUROPÉEN DES BREVETS - LA HAYE

REFUND OF THE SEARCH FEE

If applicable under Article 10 Rules relating to fees, a separate communication from the Receiving Section on the refund of the search fee will be sent later.

European Patent Office

SUPPLEMENTARY EUROPEAN SEARCH REPORT

Application Number
EP 99 94 3376

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	PATENT ABSTRACTS OF JAPAN vol. 013, no. 116 (P-845), 22 March 1989 (1989-03-22) -& JP 63 291271 A (HITACHI LTD), 29 November 1988 (1988-11-29)	1,7	G11B5/48 G11B5/55 G11B5/596 G11B5/60 G11B21/10
A	* abstract *	70	
A	US 5 745 319 A (OHTSUBO YASUO ET AL) 28 April 1998 (1998-04-28) * column 7, line 63 - column 8, line 26; figure 11 *	1,7,70	
A,D	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 07, 31 July 1997 (1997-07-31) -& JP 09 073746 A (FUJITSU LTD), 18 March 1997 (1997-03-18) * abstract *	1,7,70	
A	US 5 325 245 A (SHIMIZU JYOUSEI ET AL) 28 June 1994 (1994-06-28) * column 5, line 37 - line 48 * * column 6, line 41 - line 48; figure 5 *	1,7,70	TECHNICAL FIELDS SEARCHED (Int.Cl.7) G11B
A	US 5 325 244 A (TAKANO HISASHI ET AL) 28 June 1994 (1994-06-28) * column 7, line 14 - line 26; figure 7 *	1,7,70	
A	US 4 858 040 A (HAZEBROUCK HENRY B) 15 August 1989 (1989-08-15) * column 3, line 14 - column 4, line 15; figures 2A,2B *	1,7,70	

-/--

The supplementary search report has been based on the last set of claims valid and available at the start of the search.

Place of search	Date of completion of the search	Examiner
MUNICH	27 November 2002	Chaumeron, B

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C04)

European Patent Office

SUPPLEMENTARY EUROPEAN SEARCH REPORT

Application Number
EP 99 94 3376

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 4 374 402 A (BLESSOM NORMAN S ET AL) 15 February 1983 (1983-02-15) * column 4, line 7 - line 16 * * column 5, line 10 - line 14 * * column 6, line 25 - line 44; figures 1,2,4A,4B *	1,7,70	
A	PATENT ABSTRACTS OF JAPAN vol. 012, no. 178 (P-708), 26 May 1988 (1988-05-26) -& JP 62 287480 A (TOSHIBA CORP), 14 December 1987 (1987-12-14) * abstract *	1,7,70	
A	PATENT ABSTRACTS OF JAPAN vol. 018, no. 117 (P-1699), 24 February 1994 (1994-02-24) -& JP 05 303859 A (ALPS ELECTRIC CO LTD), 16 November 1993 (1993-11-16) * abstract *	1,7,70	
A	PATENT ABSTRACTS OF JAPAN vol. 007, no. 228 (P-228), 8 October 1983 (1983-10-08) & JP 58 118024 A (TOKYO SHIBAURA DENKI KK), 13 July 1983 (1983-07-13) * abstract *	1,7,70	TECHNICAL FIELDS SEARCHED (Int.Cl.7)

The supplementary search report has been based on the last set of claims valid and available at the start of the search.

Place of search	Date of completion of the search	Examiner
MUNICH	27 November 2002	Chaumeron, B

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C04)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 94 3376

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

27-11-2002

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 63291271 A	29-11-1988	NONE	
US 5745319 A	28-04-1998	JP 6259905 A JP 6309822 A	16-09-1994 04-11-1994
JP 09073746 A	18-03-1997	NONE	
US 5325245 A	28-06-1994	JP 3042794 B2 JP 4283480 A	22-05-2000 08-10-1992
US 5325244 A	28-06-1994	JP 3166181 B2 JP 4274001 A	14-05-2001 30-09-1992
US 4858040 A	15-08-1989	JP 1067778 A	14-03-1989
US 4374402 A	15-02-1983	NONE	
JP 62287480 A	14-12-1987	NONE	
JP 05303859 A	16-11-1993	NONE	
JP 58118024 A	13-07-1983	NONE	

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09/787400
Translation
5000

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P21480-P0	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/JP99/05061	International filing date (*day/month/year*) 16 September 1999 (16.09.99)	Priority date (*day/month/year*) 16 September 1998 (16.09.98)
International Patent Classification (IPC) or national classification and IPC G11B 5/596, 21/10		
Applicant MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 14 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
17 April 2000 (17.04.00)	27 December 2000 (27.12.2000)
Name and mailing address of the IPEA/JP Facsimile No.	Authorized officer Telephone No.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/JP99/05061

I. Basis of the report

1. With regard to the **elements** of the international application:*

☐ the international application as originally filed

☒ the description:

pages 1-2,6-8,10-39, as originally filed
pages _____, filed with the demand
pages 3-5,9,9/1, filed with the letter of 25 September 2000 (25.09.2000)

☒ the claims:

pages 2-5,8-21,24-69,71-93, as originally filed
pages _____, as amended (together with any statement under Article 19
pages _____, filed with the demand
pages 1,6-7,22-23,70, filed with the letter of 25 September 2000 (25.09.2000)

☒ the drawings:

pages 1-30, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the sequence listing part of the description:

pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rule 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.*

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	2-6,8-13,16-25,28-69,72,73,75-77,84-93	YES
	Claims	1,7,14,15,26,27,70,71,74,78-83	NO
Inventive step (IS)	Claims	11	YES
	Claims	1-10,12-93	NO
Industrial applicability (IA)	Claims	1-93	YES
	Claims		NO

2. Citations and explanations

Claims 1, 7, 14, 15, 26, 27, 70, 71, 74 and 78 to 83

Document 1 (JP, 63-291271, A (Hitachi, Ltd.), November 29, 1988 (29.11.88), entire text; Fig. 1 to 4) discloses a head support mechanism, and a method for manufacturing the same, that is provided with a head and a slider supporting said head and in which the head is tracked by the main driving means, wherein the head support mechanism is additionally provided with a flexure and an auxiliary driving means formed on the flexure makes the head formed of a thin film move very slightly. Since the inventions disclosed in Claims 1, 7, 14, 15, 26, 27, 70, 71, 74 and 78 to 83 are included in the head support mechanism disclosed in the above-mentioned Document 1, these claims lack novelty.

Claims 2 to 5, 8, 9, 41 to 48 and 71 to 93

Document 2 (JP, 10-209517, A (Matsushita Electric Industrial Co., Ltd.), August 7, 1998 (07.08.98), entire text; Fig. 1 to 6) discloses a piezoelectric body comprising a PZT thin film formed using the sputtering method and a method for manufacturing the same. It would be obvious to a person skilled in the art to use the piezoelectric body and the method for manufacturing the same disclosed in Document 2 as the piezoelectric body

comprising a thin film disclosed in Document 1.

Claims 6, 10, 12, 13, 16 to 25, 28, 29 and 31 to 39

Document 3 (JP, 10-177772, A (Sony Corp.), June 30, 1998 (30.06.98), entire text; Fig. 1 to 18) discloses a head support mechanism comprising a plurality of flat spring sections which are formed in a shape that radiates out from the rotational centre and formed to be essentially perpendicular with the surface of a disk and a head support mechanism comprising a first member and a second member. It would be obvious to a person skilled in the art to use the head support mechanism disclosed in Document 3 as the head support mechanism disclosed in Document 1.

Concerning Claim 30

Document 4 (JP, 10-134534, A (Hitachi, Ltd.), May 22, 1998 (22.05.98), entire text) discloses the feature of making the rotational centre and the centre of gravity of the first member match. It would be obvious to a person skilled in the art to use the first member disclosed in Document 4 as the first members of the head support mechanisms disclosed in Documents 1 and 3.

Claims 40 to 69

It would be obvious to a person skilled in the art to use the piezoelectric body disclosed in Document 2 and the head support mechanism disclosed in Document 3 as the piezoelectric body and the head support mechanism disclosed in Document 1.

特　許　協　力　条　約

PCT

国際予備審査報告

（法第１２条、法施行規則第56条）
〔ＰＣＴ３６条及びＰＣＴ規則70〕

出願人又は代理人の書類記号　Ｐ２１４８０－Ｐ０	今後の手続きについては、国際予備審査報告の送付通知（様式ＰＣＴ／ＩＰＥＡ／４１６）を参照すること。	
国際出願番号 ＰＣＴ／ＪＰ９９／０５０６１	国際出願日（日.月.年）　１６．０９．９９	優先日（日.月.年）　１６．０９．９８
国際特許分類（ＩＰＣ） Ｉｎｔ．Ｃｌ⁷　Ｇ１１Ｂ５／５９６，Ｇ１１Ｂ２１／１０		
出願人（氏名又は名称） 松下電器産業株式会社		

１．　国際予備審査機関が作成したこの国際予備審査報告を法施行規則第57条（ＰＣＴ３６条）の規定に従い送付する。

２．　この国際予備審査報告は、この表紙を含めて全部で　4　ページからなる。

[X] この国際予備審査報告には、附属書類、つまり補正されて、この報告の基礎とされた及び／又はこの国際予備審査機関に対してした訂正を含む明細書、請求の範囲及び／又は図面も添付されている。
（ＰＣＴ規則70.16及びＰＣＴ実施細則第６０７号参照）
この附属書類は、全部で　１４　ページである。

３．　この国際予備審査報告は、次の内容を含む。

- I [X] 国際予備審査報告の基礎
- II [ ] 優先権
- III [ ] 新規性、進歩性又は産業上の利用可能性についての国際予備審査報告の不作成
- IV [ ] 発明の単一性の欠如
- V [X] ＰＣＴ３５条(2)に規定する新規性、進歩性又は産業上の利用可能性についての見解、それを裏付けるための文献及び説明
- VI [ ] ある種の引用文献
- VII [ ] 国際出願の不備
- VIII [ ] 国際出願に対する意見

国際予備審査の請求書を受理した日　１７．０４．００	国際予備審査報告を作成した日　２７．１２．００	
名称及びあて先 日本国特許庁（ＩＰＥＡ／ＪＰ） 郵便番号１００－８９１５ 東京都千代田区霞が関三丁目４番３号	特許庁審査官（権限のある職員） 山澤　宏 電話番号　０３－３５８１－１１０１　内線　３５５０	5D　９１９８

様式ＰＣＴ／ＩＰＥＡ／４０９（表紙）（１９９８年７月）

国際予備審査報告

国際出願番号　ＰＣＴ／ＪＰ９９／０５０６１

Ⅰ．　国際予備審査報告の基礎

1．　この国際予備審査報告は下記の出願書類に基づいて作成された。（法第６条（ＰＣＴ１４条）の規定に基づく命令に応答するために提出された差し替え用紙は、この報告書において「出願時」とし、本報告書には添付しない。ＰＣＴ規則70.16, 70.17）

☐ 出願時の国際出願書類

☒ 明細書　第 1-2, 6-8, 10-39 ページ、　出願時に提出されたもの
明細書　第 　　ページ、　国際予備審査の請求書と共に提出されたもの
明細書　第 3-5, 9, 9/1 ページ、　２５．０９．００ 付の書簡と共に提出されたもの

☒ 請求の範囲　第 2-5, 8-21, 24-69, 71-93 項、　出願時に提出されたもの
請求の範囲　第 　　項、　ＰＣＴ１９条の規定に基づき補正されたもの
請求の範囲　第 　　項、　国際予備審査の請求書と共に提出されたもの
請求の範囲　第 1, 6-7, 22-23, 70 項、　２５．０９．００ 付の書簡と共に提出されたもの

☒ 図面　第 1-30 ~~ページ~~図、　出願時に提出されたもの
図面　第 　　ページ／図、　国際予備審査の請求書と共に提出されたもの
図面　第 　　ページ／図、　　付の書簡と共に提出されたもの

☐ 明細書の配列表の部分　第 　　ページ、　出願時に提出されたもの
明細書の配列表の部分　第 　　ページ、　国際予備審査の請求書と共に提出されたもの
明細書の配列表の部分　第 　　ページ、　　付の書簡と共に提出されたもの

2．　上記の出願書類の言語は、下記に示す場合を除くほか、この国際出願の言語である。

上記の書類は、下記の言語である 　　語である。

☐ 国際調査のために提出されたＰＣＴ規則23.1(b)にいう翻訳文の言語
☐ ＰＣＴ規則48.3(b)にいう国際公開の言語
☐ 国際予備審査のために提出されたＰＣＴ規則55.2または55.3にいう翻訳文の言語

3．　この国際出願は、ヌクレオチド又はアミノ酸配列を含んでおり、次の配列表に基づき国際予備審査報告を行った。

☐ この国際出願に含まれる書面による配列表
☐ この国際出願と共に提出されたフレキシブルディスクによる配列表
☐ 出願後に、この国際予備審査（または調査）機関に提出された書面による配列表
☐ 出願後に、この国際予備審査（または調査）機関に提出されたフレキシブルディスクによる配列表
☐ 出願後に提出した書面による配列表が出願時における国際出願の開示の範囲を超える事項を含まない旨の陳述書の提出があった
☐ 書面による配列表に記載した配列とフレキシブルディスクによる配列表に記録した配列が同一である旨の陳述書の提出があった。

4．　補正により、下記の書類が削除された。
☐ 明細書　第 　　ページ
☐ 請求の範囲　第 　　項
☐ 図面　図面の第 　　ページ／図

5．☐ この国際予備審査報告は、補充欄に示したように、補正が出願時における開示の範囲を越えてされたものと認められるので、その補正がされなかったものとして作成した。（ＰＣＴ規則70.2(c)　この補正を含む差し替え用紙は上記１．における判断の際に考慮しなければならず、本報告に添付する。）

国際予備審査報告

国際出願番号　ＰＣＴ／ＪＰ９９／０５０６１

Ⅴ．　新規性、進歩性又は産業上の利用可能性についての法第１２条（ＰＣＴ３５条(2)）に定める見解、それを裏付ける文献及び説明

１．　見解

新規性（Ｎ）
請求の範囲　2-6, 8-13, 16-25, 28-69, 72, 73, 75-77, 84-93　有
請求の範囲　1, 7, 14, 15, 26, 27, 70, 71, 74, 78-83　無

進歩性（ＩＳ）
請求の範囲　11　有
請求の範囲　1-10, 12-93　無

産業上の利用可能性（ＩＡ）
請求の範囲　1-93　有
請求の範囲　　無

２．　文献及び説明（ＰＣＴ規則70.7）

請求項１，７，１４，１５，２６，２７，７０，７１，７４，７８－８３
文献１：ＪＰ，６３－２９１２７１，Ａ（株式会社日立製作所）
２９．１１月．１９８８（２９．１１．８８），全文，第１－４図
には、ヘッドとヘッドを保持するスライダとを備え、ヘッドは主駆動手段によってトラッキングされるヘッド支持機構であって、ヘッド支持機構は、スライダを支持するフレクスチャをさらに備え、薄膜で構成されヘッドを微動させる副駆動手段がフレクスチャに形成されたヘッド支持機構及びその製造方法が記載されており、請求の範囲１，７，１４，１５，２６，２７，７０，７１，７４，７８－８３に記載された発明は、上記文献１に記載されたヘッド支持機構の一部をなすものであり、新規性を有しない。

請求の範囲２－５，８，９，４１－４８，７１－９３
文献２：ＪＰ，１０－２０９５１７，Ａ（松下電器産業株式会社）
７．８月．１９９８（０７．０８．９８），全文，第１－６図
には、スパッタ法により作成したＰＺＴ薄膜からなる圧電体及びその製造方法が記載されており、文献２に記載された圧電体及びその製造方法を、文献１に記載された薄膜からなる圧電体として使用することは、当業者にとって自明のものである。

請求の範囲６，１０，１２－１３，１６－２５，２８，２９，３１－３９
文献３：ＪＰ，１０－１７７７２，Ａ（ソニー株式会社）
３０．６月．１９９８（３０．０６．９８），全文，第１－１８図
には、ヘッド支持機構が、回転中心から放射状であり、またデイスクの表面に対して実質的に垂直に形成された複数の板バネ部からなるもの、及び、ヘッド支持機構を第１の部材と第２の部材とで構成したものが記載されており、文献３に記載されたヘッド支持機構を、文献１に記載されたヘッド支持機構として使用することは、当業者にとって自明のものである。

補充欄（いずれかの欄の大きさが足りない場合に使用すること）

第　V.2　欄の続き

請求の範囲３０について
文献４：ＪＰ，１０－１３４５３４，，Ａ（株式会社日立製作所）
２２．５月．１９９８（２２．０５．９８），全文，第
には、第１の部材の回転中心と重心を一致させたものが記載されており、文献４に記載された第１の部材を、文献１及び文献３に記載されたヘッド支持機構の第１の部材として使用することは、当業者にとって自明のものである。

請求の範囲４０－６９
文献２に記載された圧電体、及び文献３に記載されたヘッド支持機構を、文献１に記載された圧電体及びヘッド支持機構として使用することは、当業者にとって自明のものである。

（歪ませる）必要があり、相対的に高い駆動印加電圧（例えば２０Ｖ）を要するという欠点がある点は上記特開平９－７３７４６号公報に開示された従来例と同様である。またこの２段制御アクチュエータはスライダの背面に搭載する形式のため、磁気ディスク装置の高さ方向の厚みが増大し、磁気ディスク装置の小型、薄型化に不向きである。

このように上記した従来の微動駆動手段では、数十Ｖ台の高い駆動印加電圧が必要である。磁気ディスク装置の再生信号レベルは概ねｍＶ台であるのに対して、上記した従来の微動駆動手段の駆動電圧は数十Ｖ台であるから、微動駆動手段の駆動による再生信号への影響が懸念される。

前述した従来例ではトラッキング方向に、トラッキングとして有効な大きな変位を得ることが難しい、あるいは大きな変位を得るために高い駆動電圧を要する等、駆動効率が悪い欠点がある。

また磁気ディスク装置の小型軽量化にも構造上不利がある。本発明はこれらの従来例の課題を解決するために為されたものである。

本発明の目的は、面記録密度の増大に伴う狭トラックピッチ化に対応して、高速、高精度トラッキングを、製造の容易さを含めて実用レベルの低駆動電圧で実現する微動駆動手段を備えたヘッド支持機構およびそれを用いた情報記録再生装置およびヘッド支持機構の製造方法を提供することにある。

発明の開示

本発明に係るヘッド支持機構は、ヘッドと該ヘッドを保持するスライダとを備え、該ヘッドは主駆動手段によってトラッキングされるヘッド支持機構であって、該ヘッド支持機構は、薄膜で構成され該ヘッドを微動させる副駆動手段をさらに備え、該ヘッド支持機構は、該スライダを支持するフレクスチャをさらに備え、該副駆動手段は、該フレクスチャに形成され、該薄膜のたわみ変形を利用して該ヘッドを微動させ、該フレクスチャは、複数の板ばね部を含み、そのことにより

上記目的が達成される。

該薄膜の膜厚は、１０μm以下であってもよい。

該薄膜は、母材上に形成され、膜厚が１０μｍ以下であり、該薄膜は、成膜プロセスを用いて該母材上に形成されてもよい。

該成膜プロセスは、直接成膜プロセスを含んでもよい。

該成膜プロセスは、転写プロセスを含んでもよい。

該ヘッド支持機構は、該複数の板ばね部が可動部の回転中心から放射状に配置され、該副駆動手段は、該回転中心を中心に該スライダを回転させ、該ヘッドをトラッキング方向に微動させてもよい。

本発明に係る情報記録再生装置は、ヘッドと該ヘッドを保持するスライダとを備えたヘッド支持機構と、該ヘッド支持機構を介して該ヘッドをトラッキングする主駆動手段とを備え、該ヘッドによりディスクに情報を記録再生する情報記録再生装置であって、該ヘッド支持機構は、薄膜で構成され該ヘッドを微動させる副駆動手段を備え、該ヘッド支持機構は、該スライダを支持するフレクスチャをさらに備え、該副駆動手段は、該フレクスチャに形成され、該薄膜のたわみ変形を利用して該ヘッドを微動させ、該フレクスチャは、複数の板ばね部を含み、そのことにより上記目的が達成される。

該薄膜は、該厚み方向が該ヘッドのトラッキング方向と実質的に一致するように形成されてもよい。

該薄膜の膜厚は、１０μｍ以下であってもよい。

該副駆動手段を構成する部材の主要部分は、該スライダの該ディスクの表面からの高さ方向の厚み内の空間内に配置されてもよい。

該副駆動手段は、該スライダの重心の該ディスクの表面からの高さ方向の位置付近に配置されてもよい。

該ヘッド支持機構は、該ディスクの表面に対して実質的に垂直に形成された複数の薄板ばね部を有していてもよい。

前記副駆動手段は、振動板となる母材をさらに含み、前記母材は、バネ材を含んでもよい。

該副駆動手段は、圧電方式、静電方式、電磁方式、磁歪方式または形状記憶合金方式のうちのいずれかの構成を有してもよい。

副副駆動手段は、圧電材料、電歪材料、磁歪材料のいずれかを含んでもよい。

該ヘッド支持機構は、該スライダに結合される第１の部材と、該主駆動手段に結合される第２の部材とを含み、該副駆動手段は、該第１の部材に形成されてもよい。

該第１の部材は、該スライダを該ディスクの表面に追従させるフレクスチャを含んでもよい。

該第１の部材は、金属薄板をさらに含み、該金属薄板は、曲げ加工により形成された曲げ加工部を有し、該副駆動手段は、該曲げ加工部に形成されてもよい。

該曲げ加工部は、該ディスクの表面に対して実質的に垂直な方向に曲げ加工され、該曲げ加工部は、曲げ加工の加工精度を高めるための溝加工部を有してもよい。

該曲げ加工部は、曲げ高さ寸法が該ディスクの回転軸方向である第１の方向における該スライダの寸法よりも小となるように形成され、該第１の方向における該副駆動手段の寸法は、該第１の方向における該スライダの寸法よりも小となるように形成されてもよい。

該ヘッド支持機構は、該副駆動手段が形成される副駆動手段形成部材をさらに備え、該副駆動手段形成部材には、該ヘッドに接続される記録再生用信号配線が形成されてもよい。

該ヘッド支持機構は、該複数の板ばね部が、該ディスクの表面に対して実質的に垂直に構成された複数の平行ばねであり、該副駆動手段は、該ヘッドをトラッキング方向に並進させてもよい。

該ヘッド支持機構は、該複数の板ばね部が前記スライダの回転中心から放射状に配置され、該副駆動手段は、該回転中心を中心に該スライダを回転させ、該ヘッドをトラッキング方向に微動させてもよい。

該複数の板ばね部は、トラッキング方向に長手方向を有する板ばね部を含んでもよい。

該複数の板ばね部は、トラッキング方向に対して実質的に直行する方向に長手

手段をさらに備え、該ヘッド支持機構は、該スライダを支持するフレクスチャをさらに備え、該副駆動手段は、該フレクスチャに形成され、該薄膜のたわみ変形を利用して該ヘッドを微動させ、該フレクスチャは、複数の板ばね部を含み、前記薄膜は、母材上に形成され、該薄膜は、成膜プロセスを用いて該母材上に形成されるヘッド支持機構の製造方法であって、成膜プロセスを用いて該薄膜を該母材上に形成する第１ステップと、該ヘッドを保持するスライダを該母材上に取り付ける第２ステップとを含み、そのことにより上記目的が達成される。

該第１ステップは、直接成膜プロセスを用いて該薄膜を該母材上に形成する第３ステップを含んでもよい。

該第３ステップは、該母材上に金属膜、下地層、圧電薄膜、金属電極膜を順次積層する第４ステップを含んでもよい。

該第３ステップは、該母材上に絶縁膜、金属膜、下地層、圧電薄膜、金属電極膜を順次積層する第４ステップを含んでもよい。

該薄膜は、金属膜を含み、該第３ステップは、真空プロセス、液中プロセスのいづれかにより該金属膜を形成する第４ステップを含んでもよい。

該第１ステップは、転写プロセスを用いて該薄膜を該母材上に形成する第３ステップを含んでもよい。

該第３ステップは、転写基板上に金属膜、下地層、圧電薄膜、金属電極膜および接着剤を順次積層する第４ステップと、該接着剤上に該母材を取り付ける第５ステップと、該転写基板を該金属膜から取り除く第６ステップとを含んでもよい。

該転写基板は、ＭｇＯ、サファイア、チタン酸ストロンチウムおよびシリコンのいずれかにより形成されてもよい。

該母材は、ステンレスで形成されてもよい。

該母材は、シリコンで形成されてもよい。

該薄膜は、圧電薄膜を含み、該第１ステップは、該圧電薄膜をｒｆスパッタリング法、イオンビームスパッタリング法、ゾル・ゲル法、ＣＶＤ法およびレーザ

ーアブレーション法のいずれかの方法で形成する第３ステップを含んでもよい。

請求の範囲

1．（補正後）　ヘッドと該ヘッドを保持するスライダとを備え、該ヘッドは主駆動手段によってトラッキングされるヘッド支持機構であって、

該ヘッド支持機構は、薄膜で構成され該ヘッドを微動させる副駆動手段をさらに備え、

該ヘッド支持機構は、該スライダを支持するフレクスチャをさらに備え、

該副駆動手段は、該フレクスチャに形成され、該薄膜のたわみ変形を利用して該ヘッドを微動させ、

該フレクスチャは、複数の板ばね部を含むヘッド支持機構。

2．該薄膜の膜厚は、１０μm以下である、請求の範囲１記載のヘッド支持機構。

3．該薄膜は、母材上に形成され、膜厚が１０μm以下であり、

該薄膜は、成膜プロセスを用いて該母材上に形成される、請求の範囲１記載のヘッド支持機構。

4．該成膜プロセスは、直接成膜プロセスを含む、請求の範囲３記載のヘッド支持機構。

5．該成膜プロセスは、転写プロセスを含む、請求の範囲３記載のヘッド支持機構。

6．（補正後）　該ヘッド支持機構は、前記複数の板ばね部が前記スライダの回転中心から放射状に配置され、

該副駆動手段は、該回転中心を中心に該スライダを回転させ、該ヘッドをトラ

ッキング方向に微動させる、請求の範囲１記載のヘッド支持機構。

7．（補正後）　ヘッドと該ヘッドを保持するスライダとを備えたヘッド支持機構と、該ヘッド支持機構を介して該ヘッドをトラッキングする主駆動手段とを備え、該ヘッドによりディスクに情報を記録再生する情報記録再生装置であって、

該ヘッド支持機構は、薄膜で構成され該ヘッドを微動させる副駆動手段を備え、該ヘッド支持機構は、該スライダを支持するフレクスチャをさらに備え、

該副駆動手段は、該フレクスチャに形成され、該薄膜のたわみ変形を利用して該ヘッドを微動させ、

該フレクスチャは、複数の板ばね部を含む情報記録再生装置。

8．該薄膜は、該厚み方向が該ヘッドのトラッキング方向と実質的に一致するように形成される、請求の範囲7記載の情報記録再生装置。

9．該薄膜の膜厚は、10μm以下である、請求の範囲7記載の情報記録再生装置。

10．該副駆動手段を構成する部材の主要部分は、該スライダの該ディスクの表面からの高さ方向の厚み内の空間内に配置される、請求の範囲7記載の情報記録再生装置。

11．該副駆動手段は、該スライダの重心の該ディスクの表面からの高さ方向の位置付近に配置される、請求の範囲7記載の情報記録再生装置。

12．該ヘッド支持機構は、該ディスクの表面に対して実質的に垂直に形成された複数の薄板ばね部を有している、請求の範囲7記載の情報記録再生装置。

１３．前記副駆動手段は、振動板となる母材をさらに含み、

前記母材は、バネ材を含む、請求の範囲１２記載の情報記録再生装置。

２０．該曲げ加工部は、曲げ高さ寸法が該ディスクの回転軸方向である第１の方向における該スライダの寸法よりも小となるように形成され、

該第１の方向における該副駆動手段の寸法は、該第１の方向における該スライダの寸法よりも小となるように形成される、請求の範囲１８記載の情報記録再生装置。

２１．該ヘッド支持機構は、該副駆動手段が形成される副駆動手段形成部材をさらに備え、

該副駆動手段形成部材には、該ヘッドに接続される記録再生用信号配線が形成される、請求の範囲７記載の情報記録再生装置。

２２．（補正後）　該ヘッド支持機構は、該複数の板ばね部が、該ディスクの表面に対して実質的に垂直に構成された複数の平行ばねであり、

該副駆動手段は、該ヘッドをトラッキング方向に並進させる、請求の範囲７記載の情報記録再生装置。

２３．（補正後）　該ヘッド支持機構は、該複数の板ばね部が前記スライダの回転中心から放射状に配置され、

該副駆動手段は、該回転中心を中心に該スライダを回転させ、該ヘッドをトラッキング方向に微動させる、請求の範囲７記載の情報記録再生装置。

２４．該複数の板ばね部は、トラッキング方向に長手方向を有する板ばね部を含む、請求の範囲２３記載の情報記録再生装置。

該ヘッドの一方の側に配置された該薄膜と該ヘッドの他方の側に配置された該薄膜とは、互いに同相の電圧が印加され、同じ方向に撓む、請求の範囲７記載の情報記録再生装置。

６４．該薄膜は、下地層を含む、請求の範囲３９記載の情報記録再生装置。

６５．該下地層は、ＰＴ層、ＰＬＴ層、ＰＢＴｉ０３層、ＳｒＴｉ０３層およびＢａＴｉ０３層のいずれかを含む、請求の範囲６４記載の情報記録再生装置。

６６．該ＰＬＴ層は、実質的にＺｒを含まない、請求の範囲６５記載の情報記録再生装置。

６７．該薄膜は、該下地層に隣接して積層された金属膜を含み、

該金属膜は、白金膜またはチタン膜のいずれかを含む、請求の範囲６４記載の情報記録再生装置。

６８．該母材は、該薄膜に電圧を印加するための配線を有する、請求の範囲３９記載の情報記録再生装置。

６９．該配線は、該母材に該薄膜が形成された後に形成される、請求の範囲６８記載の情報記録再生装置。

７０．（補正後）　ヘッドと該ヘッドを保持するスライダとを備え、該ヘッドは主駆動手段によってトラッキングされるヘッド支持機構であって、該ヘッド支持機構は、薄膜で構成され該ヘッドを微動させる副駆動手段をさらに備え、該ヘッド支持機構は、該スライダを支持するフレクスチャをさらに備え、該副駆動手

段は、該フレクスチャに形成され、該薄膜のたわみ変形を利用して該ヘッドを微動させ、該フレクスチャは、複数の板ばね部を含み、前記薄膜は、母材上に形成さ

AMENDMENT BRIEF
(Amendment under Section 11)

To: Commissioner of the Patent Office

1. Identification of International Application
PCT/JP99/05061

2. Applicant
Name: MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.
Address: 1006, Oaza Kadoma, Kadoma-shi,
Osaka 571-8501 Japan
Country of nationality: Japan
Country of residence: Japan

3. Agent
Name: (7828) YAMAMOTO Shusaku
Address: Fifteenth Floor, Crystal Tower, 2-27, Shiromi
1-chome, Chuo-ku, Osaka-shi,
Osaka 540-6015 Japan

4. Item to be Amended
Claims and the specification

5. Subject Matter of Amendment

The claims are amended as follows:

(1) At page 40, line 7 [corresponding to page 64, lines 9-11 of the translated (English) specification], "the driving sub-means causes the head to have a micro-movement by utilizing flexural deformation of the thin film" is amended to --the head support mechanism further comprises

a flexure for supporting the slider; the driving sub-means is formed on the flexure and causes the head to have a micro-movement by utilizing flexural deformation of the thin film; and the flexure includes a plurality of plate spring portions--.

(2) At page 40, lines 22-24 [corresponding to page 64, line 31 to page 64, line 2 of the translated (English) specification], "the head support mechanism includes a plurality of plate spring portions disposed in a radial arrangement from a rotation center; the driving sub-means is formed on the plurality of plate spring portions" is amended to -- the plurality of plate spring portions of the head support mechanism are disposed in a radial arrangement from a rotation center of the slider--.

(3) At page 41, line 6, [corresponding to page 65, lines 16-18 of the translated (English) specification] "the driving sub-means causes the head to have a micro-movement by utilizing flexural deformation of the thin film" is amended to --the head support mechanism further comprises a flexure for supporting the slider; the driving sub-means is formed on the flexure and causes the head to have a micro-movement by utilizing flexural deformation of the thin film; and the flexure includes a plurality of plate spring portions--.

(4) At page 43, lines 12-14 [corresponding to page 68, lines 8-12 of the translated (English) specification], "the head support mechanism includes a plurality of parallel spring portions formed substantially perpendicular to the disk surface; the driving sub-means is formed on the plurality of parallel spring portions" is amended to --

the plurality of plate spring portions of the head support mechanism are a plurality of parallel springs formed substantially perpendicular to the disk surface--.

(5) At page 43, lines 18-20 [corresponding to page 68, lines 18-22 of the translated (English) specification], "the head support mechanism includes a plurality of plate spring portions disposed in a radial arrangement from a rotation center; the driving sub-means is formed on the plurality of plate spring portions" is amended to --the plurality of plate spring portions of the head support mechanism are disposed in a radial arrangement from a rotation center of the slider--.

(6) At page 49, line 25 [corresponding to page 76, lines 19-21 of the translated (English) specification], "the driving sub-means causes the head to have a micro-movement by utilizing flexural deformation of the thin film" is amended to --the head support mechanism further comprises a flexure for supporting the slider; the driving sub-means is formed on the flexure and causes the head to have a micro-movement by utilizing flexural deformation of the thin film; the flexure includes a plurality of plate spring portions--.

The specification is amended as follows:

(7) At page 3, line 24 [corresponding to page 5, lines 18-20 of the translated (English) specification], "the driving sub-means causes the head to have a micro-movement by utilizing flexural deformation of the thin film" is amended to --the head support mechanism further comprises

a flexure for supporting the slider; the driving sub-means is formed on the flexure and cause the head to have a micro-movement by utilizing flexural deformation of the thin film; and the flexure includes a plurality of plate spring portions--.

(8) At page 4, lines 5-6 [corresponding to page 6, lines 4-5 of the translated (English) specification], "The thin film and the slider may be disposed along a tracking direction of the head" is amended to --The plurality of plate spring portions of the head support mechanism may be disposed in a radial arrangement from a rotation center of the slider--.

(9) At page 4, lines 11-12 [corresponding to page 6, lines 16-18 of the translated (English) specification], "the driving sub-means causes the head to have a micro-movement by utilizing flexural deformation of the thin film" is amended to --the head support mechanism further comprises a flexure for supporting the slider; the driving sub-means is formed on the flexure and cause the head to have a micro-movement by utilizing flexural deformation of the thin film; and the flexure includes a plurality of plate spring portions--.

(10) At page 5, lines 18-19 [corresponding to page 8, lines 18-21 of the translated (English) specification], "The head support mechanism may include a plurality of parallel spring portions formed substantially perpendicular to the disk surface; the driving sub-means may be formed on the plurality of parallel spring portions" is amended to --The plurality of plate spring portions of the head support mechanism may be a plurality of parallel

springs formed substantially perpendicular to the disk surface--.

(11) At page 5, lines 21-22 [corresponding to page 8, lines 25-28 of the translated (English) specification], "The head support mechanism may include a plurality of plate spring portions disposed in a radial arrangement from a rotation center; the driving sub-means may be formed on the plurality of plate spring portions" is amended to --The plurality of plate spring portions of the head support mechanism may be disposed in a radial arrangement from a rotation center of the slider--.

(12) At page 9, line 1 [corresponding to page 14, lines 20-22 of the translated (English) specification], "the driving sub-means causes the head to have a micro-movement by utilizing flexural deformation of the thin film" is amended to --the head support mechanism further comprises a flexure for supporting the slider; the driving sub-means is formed on the flexure and cause the head to have a micro-movement by utilizing flexural deformation of the thin film; the flexure includes a plurality of plate spring portions--.

6. List of Attached Documents

"Claims": new sheets of p. 40, p. 40/1, p. 41, p. 41/1, p. 43, p. 49, p. 49/1 (one each) [corresponding to p. 64, p. 65, p. 66, p. 66/1, p. 67, p. 68, p. 75, p. 76, p. 76/1 of the translated (English) specification]

"Specification": new sheets of p. 3, p. 3/1, p. 4, p. 4/1,

p. 5, p. 9, p. 9/1 (one each)
[corresponding to p. 3, p. 4, p. 5, p. 5/1, p. 6, p. 7, p. 7/1, p. 8, p. 9, p. 14, p. 15, p. 16, p. 16/1 of the translated (English) specification]

for serving the latter function is referred to as a flexure or gimbal (hereinafter referred to as a "flexure").

Japanese Laid-open Publication No. 9-73746 discloses a head support mechanism including micro-movement driving means such that first and second piezoelectric thin films are provided in parallel on one surface of a load beam in a longitudinal direction thereof, and third and fourth piezoelectric thin films are provided facing the opposite surface. However, in order to obtain a large displacement for enabling tracking in this structure, it is necessary to expand or contract (deform) the piezoelectric thin films against a substantial inplane rigidity, which requires a high driving voltage (e. g., 50 V) because the expansion and contraction directions (displacement direction) of the piezoelectric thin film are within the plane of the piezoelectric thin film.

Japan Society of Mechanical Engineers, the 75th Ordinary General Meeting Convention Speech Papers (IV) (1998, March 31 to April 3, Tokyo), pp. 208-209 discloses a two-stage controlled actuator mounted on a back face of a slider. This amounts to a driving mode in which piezoelectric ceramics are employed as micro-movement driving means, and in which a multi-layer structure is adopted in order to reduce a driving voltage. A multi-layer structure including a multitude of layers is designed so as to reduce a driving voltage. In this case, too, the expansion and contraction directions (displacement direction) of the piezoelectric ceramics are within the plane of the piezoelectric ceramics multi-layer structure. Therefore, the piezoelectric ceramics need to be expanded or contracted (deformed) against a substantial inplane

rigidity, which disadvantageously requires a considerably high applied driving voltage (e. g., 20 V), similar to the above-described conventional example disclosed in Japanese Laid-open Publication No. 9-73746. Since this two-stage controlled actuator is of a type which is mounted on the back face of a slider, a thickness of the magnetic disk apparatus in a height direction thereof is increased, which hinders the reduction in size and thickness of the magnetic disk apparatus.

An applied driving voltage of several tens of volts is required for the above-described conventional micro-movement driving means. Whereas a typical reproduction signal in a magnetic disk apparatus is generally on the order of millivolts, the driving voltage for the above-described conventional micro-movement driving means is on the order of several tens of volts. Therefore, some influence is expected on the reproduction signal due to the driving of the micro-movement driving means.

With the above-described conventional example, it may be difficult to obtain a large displacement for tracking along a tracking direction, or a high driving voltage may be required to obtain a large displacement, indicative of problems associated with a poor driving efficiency.

Furthermore, there are structural disadvantages in view of reduction in size and mass of the magnetic disk apparatus. The present invention was made in order to solve these conventional problems.

An objective of the present invention is to provide: a head support mechanism including micro-movement driving

means which realizes high-speed and high-precision tracking so as to be compatible with narrow track pitches required due to an increasing areal recording density while the micro-movement driving means is easy to produce and is driven with a low driving voltage at a practical level; an information recording/reproducing apparatus incorporating the same; and a method of manufacturing the head support mechanism.

DISCLOSURE OF THE INVENTION

A head support mechanism according to the present invention is a head support mechanism comprising a head and a slider for carrying the head, the head being caused to track by main driving means, wherein: the head support mechanism further comprises driving sub-means comprising a thin film and causing the head to have a micro-movement; and the head support mechanism further comprises a flexure for supporting the slider; the driving sub-means is formed on the flexure and cause the head to have a micro-movement by utilizing flexural deformation of the thin film; and the flexure includes a plurality of plate spring portions. As a result, the aforementioned objective of the present invention is accomplished.

The thin film may have a film thickness equal to or less than 10μm.

The thin film may be formed on a base material and has a film thickness equal to or less than 10μm; and the thin film may be formed on the base material by using a film growth process.

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The film growth process may comprise a direct film growth process.

The film growth process may comprise a transcription process.

The plurality of plate spring portions of the head support mechanism may be disposed in a radial arrangement from a rotation center of the slider.

An information recording/reproducing apparatus according to the present invention is an information recording/reproducing apparatus comprising: a head support mechanism having a head and a slider for carrying the head; main driving means for causing the head to track via the head support mechanism, so that information on a disk is recorded/reproduced by means of the head, wherein: the head support mechanism comprises driving sub-means comprising a thin film and causing the head to have a micro-movement; and the head support mechanism further comprises a flexure for supporting the slider; the driving sub-means is formed on the flexure and cause the head to have a micro-movement by utilizing flexural deformation of the thin film; and the flexure includes a plurality of plate spring portions. As a result, the aforementioned objective of the present invention is accomplished.

The thin film may be formed so that the thickness direction substantially coincides with a tracking direction of the head.

The thin film may have a film thickness equal to or less than 10μm.

A main portion of a member comprised by the driving sub-means may be disposed in a space within the thickness,

from the disk surface, of the slider along a height direction.

The driving sub-means may be in the vicinity of a position along a height direction from the disk surface of a center of gravity of the slider.

The head support mechanism may include a plurality of thin plate spring portions formed substantially perpendicular to the disk surface.

The driving sub-means further may comprise a base material to function as an actuating plate; and the base material may comprise a spring material.

The driving sub-means may be of a piezoelectric type, electrostatic type, electromagnetic type, magnetostrictive type, or shape memory alloy type.

The driving sub-means may comprise a piezoelectric material, electrostrictive material, or magnetostrictive material.

The head support mechanism may comprise: a first member coupled to the slider; and a second member coupled to the main driving means, wherein the driving sub-means may be formed on the first member.

The first member may comprise a flexure for causing the slider to follow the disk surface.

The first member may further comprise a thin metal plate; the thin metal plate includes a bent portion which

is formed by bending; and the driving sub-means may be formed on the bent portion.

The bent portion may be bent in a direction which

is substantially perpendicular to the disk surface; and the bent portion may include a grooved portion for enhancing the processing precision of the bending.

The bent portion may be formed so that its bent height dimension is smaller than a dimension of the slider along a first direction which is a rotation axis direction of the disk; and a dimension of the driving sub-means along the first direction may be smaller than the dimension of the slider along the first direction.

The head support mechanism may further comprise a driving sub-means formation member on which the driving sub-means is formed; and recording/reproducing signal wiring coupled to the head may be formed on the driving sub-means formation member.

The plurality of plate spring portions of the head support mechanism may be a plurality of parallel springs formed substantially perpendicular to the disk surface; and the driving sub-means may translate the head along a tracking direction.

The plurality of plate spring portions of the head support mechanism may be disposed in a radial arrangement from a rotation center of the slider; and the driving sub-means may rotate the slider around the rotation center, and cause the head to have a micro-movement along a tracking direction.

The plurality of plate spring portions may comprise a plate spring portion having a longitudinal direction along the tracking direction.

The plurality of plate spring portions may comprise a plate spring portion having a longitudinal direction along a direction substantially perpendicular to the tracking direction.

The head support mechanism may comprise a pair of driving sub-means.

The driving sub-means may be located so as to be substantially parallel to a direction in which the slider is disposed.

The driving sub-means may be disposed in such a manner that extensions of directions in which the driving sub-means are disposed constitute predetermined angles with respect to an extension of a direction in which the slider is disposed, so as to intersect at a leading end of the head support mechanism.

The driving sub-means may constitute an angle equal to or greater than 15° with a plane perpendicular to disk surface.

The head support mechanism may further comprise a first member coupled to the slider; the driving sub-means may be formed on the first member; and the driving sub-means may be disposed in such a manner that a center of gravity of the first member is located in the vicinity of an intersection between extensions of directions in which the driving sub-means are disposed.

The PLT layer may contain substantially no Zr.

The thin film may comprise a metal film which is layered adjacent to the underlying layer; and the metal film may comprise either a platinum film or a titanium film.

The base material may include wiring for applying a voltage to the thin film.

The wiring may be formed after the thin film is formed on the base material.

A method for manufacturing a head support mechanism is a method for manufacturing a head support mechanism comprising a head and a slider for carrying the head, the head being caused to track by main driving means, wherein: the head support mechanism further comprises driving sub-means comprising a thin film and causing the head to have a micro-movement; the head support mechanism further comprises a flexure for supporting the slider; the driving sub-means is formed on the flexure and cause the head to have a micro-movement by utilizing flexural deformation of the thin film; the flexure includes a plurality of plate spring portions; the thin film is formed on a base material; and the thin film is formed on the base material by using a film growth process, comprising: a first step of forming the thin film on the base material by using a film growth process; and a second step of attaching the slider carrying the head onto the base material. As a result, the aforementioned objective of the present invention is accomplished.

The first step may comprise a third step of forming the thin film on the base material by using a direct film growth process.

The third step may comprise a fourth step of sequentially layering a metal film, an underlying layer, a thin film piezoelectric, and a metal electrode film on the base material.

The third step may comprise a fourth step of sequentially layering an insulation film, a metal film, an underlying layer, a thin film piezoelectric, and a metal electrode film on the base material.

The thin film may comprise a metal film; and the third step may comprise a fourth step of forming the metal film by either a vacuum process or a process in a liquid.

The first step may comprise a third step of forming the thin film on the base material by using a transcription process.

The third step may comprise: a fourth step of sequentially layering a metal film, an underlying layer, a thin film piezoelectric, and a metal electrode film on a transcription substrate; a fifth step of adhering the base material to a layering surface of the transcription substrate; and a sixth step of removing the transcription substrate from the metal film.

The transcription substrate may be formed of MgO, sapphire, strontium titanate, or silicon.

The base material may be formed of stainless steel.

The base material may be formed of silicon.

The thin film may comprise a thin film piezoelectric; the first step may comprise a third step of forming the thin film piezoelectric by an rf sputtering method, an ion beam sputtering method, a sol-gel method, a CVD method, or a laser ablation method.

The first step may comprise a third step of forming the thin film on both sides of the base material so as to interpose the base material therebetween.

The thin film may comprise a thin film piezoelectric; and the first step may comprise a third step of forming the thin film piezoelectric.

The thin film piezoelectric may comprise a PZT film.

The thin film piezoelectric may comprise a ZnO film.

The thin film piezoelectric may comprise a PVDF film.

The thin film may comprise a thin film piezoelectric; and the first step may comprise a third step of entirely covering the thin film piezoelectric with an insulation film.

The insulation film may comprise a material whose main component is of polyimide, an SAM film, an LB film, or nitride.

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The first step may comprise a third step of forming the thin film on both sides of a position at which the head

CLAIMS

1.(Amended) A head support mechanism comprising a head and a slider for carrying the head, the head being caused to track by main driving means, wherein:

the head support mechanism further comprises driving sub-means comprising a thin film and causing the head to have a micro-movement;

the head support mechanism further comprises a flexure for supporting the slider;

the driving sub-means is formed on the flexure and causes the head to have a micro-movement by utilizing flexural deformation of the thin film; and

the flexure includes a plurality of plate spring portions.

2. A head support mechanism according to claim 1, wherein the thin film has a film thickness equal to or less than 10μm.

3. A head support mechanism according to claim 1, wherein:

the thin film is formed on a base material and has a film thickness equal to or less than 10μm; and

the thin film is formed on the base material by using a film growth process.

4. A head support mechanism according to claim 3, wherein the film growth process comprises a direct film growth process.

5. A head support mechanism according to claim 3, wherein the film growth process comprises a transcription process.

6.(Amended) A head support mechanism according to claim 1, wherein the plurality of plate spring portions of the head support mechanism are disposed in a radial arrangement from a rotation center of the slider;

the driving sub-means rotates the slider around the rotation center, causing the head to have a micro-movement along a tracking direction.

7.(Amended) An information recording/reproducing apparatus comprising: a head support mechanism having a head and a slider for carrying the head; main driving means for causing the head to track via the head support mechanism, so that information on a disk is recorded/reproduced by means of the head, wherein:

the head support mechanism comprises driving sub-means comprising a thin film and causing the head to have a micro-movement;

the head support mechanism further comprises a flexure for supporting the slider;

the driving sub-means is formed on the flexure and causes the head to have a micro-movement by utilizing flexural deformation of the thin film; and

the flexure includes a plurality of plate spring portions.

8. An information recording/reproducing apparatus according to claim 7, wherein the thin film is formed so that the thickness direction substantially coincides with a tracking direction of the head.

9. An information recording/reproducing apparatus according to claim 7, wherein the thin film has a film

thickness equal to or less than 10 μm.

10. An information recording/reproducing apparatus according to claim 7, wherein a main portion of a member comprised by the driving sub-means is disposed in a space within the thickness, from the disk surface, of the slider along a height direction.

11. An information recording/reproducing apparatus according to claim 7, wherein the driving sub-means is in the vicinity of a position along a height direction from the disk surface of a center of gravity of the slider.

12. An information recording/reproducing apparatus according to claim 7, wherein the head support mechanism includes a plurality of thin plate spring portions formed substantially perpendicular to the disk surface.

13. An information recording/reproducing apparatus according to claim 12, wherein:

the driving sub-means further comprises a base material to function as an actuating plate; and

the base material comprises a spring material.

14. An information recording/reproducing apparatus according to claim 7, wherein the driving sub-means is of a piezoelectric type, electrostatic type, electromagnetic type, magnetostrictive type, or shape memory alloy type.

15. An information recording/reproducing apparatus according to claim 7, wherein the driving sub-means comprises a piezoelectric material, electrostrictive material, or magnetostrictive material.

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16. An information recording/reproducing apparatus according to claim 7, wherein the head support mechanism comprises:

a first member coupled to the slider; and

a second member coupled to the main driving means,

wherein the driving sub-means is formed on the first

member.

17. An information recording/reproducing apparatus according to claim 16, wherein the first member comprises a flexure for causing the slider to follow the disk surface.

18. An information recording/reproducing apparatus according to claim 7, wherein:

the first member further comprises a thin metal plate;

the thin metal plate includes a bent portion which is formed by bending; and

the driving sub-means is formed on the bent portion.

19. An information recording/reproducing apparatus according to claim 18, wherein:

the bent portion is bent in a direction which is substantially perpendicular to the disk surface; and

the bent portion includes a grooved portion for enhancing the processing precision of the bending.

20. An information recording/reproducing apparatus according to claim 18, wherein:

the bent portion is formed so that its bent height dimension is smaller than a dimension of the slider along a first direction which is a rotation axis direction of the disk; and

a dimension of the driving sub-means along the first direction is smaller than the dimension of the slider along the first direction.

21. An information recording/reproducing apparatus according to claim 7, wherein:

the head support mechanism further comprises a driving

sub-means formation member on which the driving sub-means is formed; and

recording/reproducing signal wiring coupled to the head is formed on the driving sub-means formation member.

22.(Amended) An information recording/reproducing apparatus according to claim 7, wherein:

the plurality of plate spring portions of the head support mechanism are a plurality of parallel springs formed substantially perpendicular to the disk surface; and

the driving sub-means translates the head along a tracking direction.

23.(Amended) An information recording/reproducing apparatus according to claim 7, wherein:

the plurality of plate spring portions of the head support mechanism are disposed in a radial arrangement from a rotation center of the slider; and

the driving sub-means rotates the slider around the rotation center, and causes the head to have a micro-movement along a tracking direction.

24. An information recording/reproducing apparatus according to claim 23, wherein the plurality of plate spring portions comprise a plate spring portion having a longitudinal direction along the tracking direction.

25. An information recording/reproducing apparatus according to claim 23, wherein the plurality of plate spring

the thin film comprises a pair of thin films;

the pair of thin films are disposed substantially parallel to the disk surface; and

voltages having reverse phases are applied to the thin film provided on one side of the head and the thin film provided on the other side of the head so that the thin films warp in opposite directions.

63. An information recording/reproducing apparatus according to claim 7, wherein:

the thin film comprises a pair of thin films;

the pair of thin films are disposed substantially parallel to the disk surface; and

voltages having the same phase are applied to the thin film provided on one side of the head and the thin film provided on the other side of the head so that the thin films warp in the same direction.

64. An information recording/reproducing apparatus according to claim 39, wherein the thin film comprises an underlying layer.

65. An information recording/reproducing apparatus according to claim 64, wherein the underlying layer comprises a PT layer, a PLT layer, a PBTi03 layer, an SrTi03 layer, or a BaTi03 layer.

66. An information recording/reproducing apparatus according to claim 65, wherein the PLT layer contains substantially no Zr.

67. An information recording/reproducing apparatus according to claim 64, wherein:

the thin film comprises a metal film which is layered adjacent to the underlying layer; and

the metal film comprises either a platinum film or a titanium film.

68. An information recording/reproducing apparatus according to claim 39, wherein the base material includes wiring for applying a voltage to the thin film.

69. An information recording/reproducing apparatus according to claim 68, wherein the wiring is formed after the thin film is formed on the base material.

70.(Amended) A method for manufacturing a head support mechanism comprising a head and a slider for carrying the head, the head being caused to track by main driving means, wherein: the head support mechanism further comprises driving sub-means comprising a thin film and causing the head to have a micro-movement; the head support mechanism further comprises a flexure for supporting the slider;

the driving sub-means is formed on the flexure and causes the head to have a micro-movement by utilizing flexural deformation of the thin film; the flexure includes a plurality of plate spring portions; the thin film is formed on a base material; and the thin film is formed on the base material by using a film growth process, comprising:

a first step of forming the thin film on the base material by using a film growth process; and

a second step of attaching the slider carrying the head onto the base material.

71. A method for manufacturing a head support mechanism according to claim 70, wherein the first step comprises a

third step of forming the thin film on the base material by using a direct film growth process.